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ABSTRACT

Two of the most widely used academic self-efficacy assessment techniques, problem-referenced measurement and the Motivated Strategies for Learning Questionnaire (MSLQ) were compared. Participants were 383 high school students from 4 Los Angeles (California) schools. Multi-trait multi-method analyses revealed that the two techniques were not measuring exactly the same thing. In particular, students' responses became more uniform in each school subject as the assessment procedures referred to more global events than specific problems. The two techniques also differed in generality. The relationship between students' verbal and mathematics self-efficacy perceptions was noticeably stronger with the problem-referenced technique than with the MSLQ. (Contains one table, three figures, and six references.) (Author/SLD)

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Effects of Scale Differences on the Generality of Academic Self-Efficacy Judgments

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Abstract

Two of the most widely used academic self-efficacy assessment techniques, problem-referenced measurement and the Motivated Strategies for Learning Questionnaire (MSLQ), were compared. Multi-trait multi-method analyses revealed that the two techniques were not measuring exactly the same thing. In particular, students' responses became more uniform in each school subject as the assessment procedures referred to more global events than specific problems. The two techniques also differed in the generality. In particular, the relationship between students' verbal and math efficacy perceptions were noticeably stronger with problem-referenced assessment technique than with the MSLQ.

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Academic self-efficacy is a predictive construct that corresponds directly to the outcome of interest (Zimmerman, 1996). Self-efficacy researchers thus assess students' efficacy beliefs toward a set of specific and particularized tasks and relate them to diverse indexes of achievement behaviors on the very tasks. It is noteworthy that most academic self-efficacy investigations so far concerned the strength of students' efficacy perception and its impact on subsequent performance. Although absolutely important in its own right, assessing strength of efficacy beliefs toward a limited range of very specific tasks does not permit researchers to make inference on the relation between various task-specific efficacy beliefs.

In fact, Bandura (1986) claimed that persons' efficacy beliefs can differ along the dimensions of strength, level, and generality. A recent investigation on the generality of academic self-efficacy judgments revealed that students' efficacy perceptions indeed generalize beyond the boundary of a single, specific task. Using confirmatory factor analyses, Bong (1997) reported that high school students' judgments of their own academic competence were more or less equivalent within the boundary of each school subject. Evidence also showed that students' efficacy beliefs might generalize even further to provide bases for two higher-order factors, verbal and math academic self-efficacy. Such results can provide valuable information for both researchers and practitioners in education, because they shed light on the possibility that efforts invested in educational intervention programs, especially those designed for bolstering students' academic confidence in specific tasks, may bring added benefits to participants.

Currently, there are two types of scales or measurement techniques most frequently utilized in academic self-efficacy research. One is to ask students to rate their confidence for successfully solving a set of specific problems presented. The other is to ask students to report their confidence for successful performance by presenting simply verbal descriptions of the tasks or domains of interest (see Pajares, 1996). Such difference in the measurement technique and specificity has been found to wield notable impact on efficacy beliefs' potency in explaining students' academic performance. The impact of scale differences on the generality of efficacy beliefs has yet to be investigated empirically. The purpose of the present investigation, therefore, is to see whether academic self-efficacy beliefs in the same domains assessed by different techniques demonstrate comparable degrees of generality and, more important, represent the same construct.

Results from the present investigation are also expected to help tease out the sources of difference between academic self-concept and self-efficacy research. Differences in theoretical stipulation set aside, there have been conspicuous differences in the assessment procedure typically associated with the two bodies of research. Unlike academic self-efficacy research that often resorts to obtaining students' confidence ratings by presenting specific tasks or problems, academic self-concept research has relied on more general, survey-type measurement procedures. Several researchers noted that such difference might have been at least partially responsible for the observed differences in the two constructs' relations to achievement as well as relations among domain-specific self-perceptions, particularly between the verbal and math selves (e.g., Marsh, Walker, & Debus, 1991).

Method and Procedures

Participants were three-hundred and eighty-three high school students (49% male, 51% female) from four Los Angeles-based high schools. The sample came from a larger study that involved 588 students (see Bong, 1997). Students (a) reported their

confidence for solving seven representative problems in six school subjects (i.e., English, Spanish, American history, algebra, geometry, and chemistry), (b) responded on the self -efficacy scale of the Motivated Strategies for Learning Questionnaire (MSLQ), and (c) reported course grades in the six subjects. Zimmerman and others (Marsh, Walker, & Debus, 1991; Zimmerman, 1995) discussed that judgment of academic self-efficacy puts heavier emphasis on mastery criteria (i.e., being able to succeed) rather than normative ones (i.e., being better than others). Accordingly, the original questions in the MSLQ were modified so that items or statements prompting normative judgment of ability were excluded. The final scale contained six questions for each school subject.

Results and Discussion

Multi-Trait Multi-Method Analysis

The present investigation involved two measurement techniques assessing academic self-efficacy judgments in the six school subjects. Before examining separately the difference due to scales on the generality of self-efficacy perceptions, a multi-trait multi-method (MTMM) design was first imposed on the data. The MTMM design allows examining (a) convergent validity of academic self-efficacy beliefs assessed by the two methods and (b) discriminant validity of the six subject-specific academic self-efficacy from each other. In particular, a MTMM design with confirmatory factor analysis (CFA) approach affords partitioning of the variance to the factor and method effects (Pedhazur & Schmelkin, 1991). Four measured variables were created for each of the six subject-specific academic self-efficacy factor by combining students' responses on two to three problems or items. Two of the four measured variables for each self-efficacy factor shared the same method, providing twelve measured variables for each method factor.

Figure 1 presents results of the MTMM analysis. The two method factor accounted for a substantial amount of the variance in each of the twenty-four measured variables. Loadings for the Problem method factor ranged from .40 to .97, whereas those for the MSLQ method factor ranged between .11 and .72. The Problem factor, in particular, wielded equal or greater effects on the indicators as the self-efficacy factors, with an exception of Spanish. Students' problem-referenced self-efficacy ratings were thus evenly influenced by their perceived capability in each school subject as well as by the nature of the problems presented. An opposite pattern was observed with the MSLQ method. Effects of the MSLQ scale were considerably less than effects from each subject-specific self-efficacy factor, again with an exception of Spanish. In other words, students' responses on the MSLQ were not influenced as much by the nature of items. Rather, students provided more uniform responses in each school subject regardless of the questions asked which resulted in most of the variance in the measured variables being determined by subject-specific self-efficacy effects.

Given the results presented up to this point, one would conclude that the MSLQ self-efficacy scale is more effective in assessing subject-specific academic self-efficacy than the problem-referenced scale. Such a claim can be qualified only when the two scales indeed tap the same psychological constructs. Unfortunately, factor loadings showed that the self-efficacy factors assessed by the two methods seriously lack convergent validity. Magnitude of paths emanating from each self-efficacy factor to its respective indicators differ substantially by the method of assessment used. The correlation coefficient between the Problem and MSLQ method factors was mere .09 ($p > .05$).

It is possible to examine the relative contribution of each construct or method in explaining the variance of measured variables by imposing equality constraints on certain parameters (Pedhazur & Schmelkin, 1991). Fixing the effects of each self-efficacy factor on its respective indicators to be equal to each other permits examination of the relative contribution of each method factor. Similarly, fixing the effects of a single method factor on multiple indicators to be equal to each other allows comparison of effects from each of the academic self-efficacy factors. Figure 2 presents results of the MTMM analysis when the equality constraints were imposed on the trait effects, whereas Figure 3 presents results with equality constraints being imposed on the method effects.

Both Figures 2 and 3 clearly demonstrate that the problem-referenced and MSLQ self-efficacy scales were not measuring exactly the same things. Figure 2 shows that measured variables based on specific problems were more heavily influenced by the method effects compared to those based on the MSLQ, when the effects from each self-efficacy factor were set to be equal for all its measured variables. More variance is attributable to method effects in the problem-based than MSLQ indicators. The difference is more pronounced in English and American history than in quantitative subjects. Also, the equal-effects-from-constructs-to-indicators constraints left most of the variance of the problem-based indicators unexplained in verbal subjects. Factor loadings after standardization ranged between .04 to .07 for the problem-referenced self-efficacy ratings. In contrast, the MSLQ variables all demonstrated loadings well above .70. The hypothesized self-efficacy constructs were thus defined mostly by the MSLQ self-efficacy scores, when the equality constraints were imposed on the construct effects.

Results of the MTMM analysis with the equal-method-effects constraints corroborated that the two methods were measuring slightly different constructs. When the effects of each method on their respective measured variables were constrained to be equal, each subject-specific academic self-efficacy factors shared substantially more variance with the MSLQ than problem-based indicators. As in all previous analyses, the difference in construct effects on measured variables were more noticeable in verbal subjects than in quantitative subjects with an exception of Spanish.

Next, correlations among self-efficacy factors were examined as a way of exploring the discriminant validity of subject-specific academic self-efficacy from each other. Table 1 presents factor correlations among the six self-efficacy factors when the two methods were combined. As can be seen, each subject-specific academic self-efficacy factors correlated from -.08 to .81 to each other, displaying that students form more or less independent perceptions of their academic capability for each school subject.

Comparison of the Generality of Academic Self-Efficacy Judgments by Each Scale

Confirmatory factor analyses were conducted separately on each data set based on each measurement technique. First, six first-order models with different degrees of generality were fitted to the data and the goodness-of-fit indexes were compared. The following are the model descriptions: Model 1 with three factors (i.e., Verbal-English, Verbal-Spanish, and Math); Model 2 with four factors (i.e., English, Spanish, History, and Math); Model 3 with four factors (i.e., Verbal-English, Verbal-Spanish, Math, and Chemistry); Model 4 with five factors (i.e., English, Spanish, History, Math, and Chemistry); Model 5 with five factors (i.e., Verbal-English, Verbal-Spanish, Algebra, Geometry, and Chemistry); and Model 6 with six factors (i.e., English, Spanish,

History, Algebra, Geometry, and Chemistry).

All six models demonstrated a better fit when they were imposed on the problem-based self-efficacy. The difference in fit was especially pronounced in Model 4 that prescribed a single factor for students' algebra and geometry efficacy ratings. The fit of Model 4 with the problem-based self-efficacy, χ^2 (125, N = 383) = 424.67, $p < .001$ (NNFI = .94, CFI = .95), was better than the fit with the MSLQ self-efficacy, χ^2 (125, N = 383) = 1019.85, $p < .001$ (NNFI = .86, CFI = .89). In other words, students made more fine distinction between their capability in algebra and that in geometry when asked more global questions than when provided with specific problems.

Two second-order factor structures were imposed on the two data sets to further test the generality of academic self-efficacy judgments. There was no noticeable difference in fit between the two data sets when both the model with General Academic Self-Efficacy and the model with Verbal and Math Academic Self-Efficacy based on the six subject-specific factors were imposed. Overall, the superior fit of all first-order models with the problem-based self-efficacy judgments than with the MSLQ efficacy scores along with results from the second-order models provided evidence that students may engage in slightly different processes or assign different weights to diverse information sources when arriving at their competence perception, depending on what or how the questions were asked.

Interestingly, the relation between Verbal and Math Academic Self-Efficacy also varied depending on the empirical data set utilized. Although the second-order model with Verbal and Math Academic Self-Efficacy accounting for the covariances in the six subject-specific efficacy factors exhibited comparable fit between the problem- and MSLQ-based data, the correlation between Verbal and Math Academic Self-Efficacy was substantially larger (.66) with the problem efficacy than with the MSLQ (.43). As discussed earlier, this result has implications for the purported difference between academic self-efficacy and self-concept research. The MSLQ scale employed in the current study is composed of six items that inquire students' perceived competence in each school subject (e.g., I'm certain that I can understand what is taught in [a specific school subject] class; I am sure that I can do an excellent job on the problems and tasks assigned for [a specific school subject] class). Even with the comparative statements removed from items, the correlation between MSLQ-based Verbal and Math Academic Self-Efficacy became conspicuously smaller compared to the one between problem-referenced efficacy factors. When we consider that academic self-concept research typically relies on more general measures compared to academic self-efficacy research, results from the present investigation clearly demonstrated the possibility that the specificity (or generality) of assessment procedures can make different facets of the self-referent thoughts more salient.

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Table 1

Correlations Among Academic Self-Efficacy Factors From Multi-Trait Multi-Method Analysis

Factors	1	2	3	4	5	6
1. English Academic Self-Efficacy	1.00					
2. Spanish Academic Self-Efficacy	-.08	1.00				
3. History Academic Self-Efficacy	.62	-.01	1.00			
4. Algebra Academic Self-Efficacy	.22	.07	.34	1.00		
5. Geometry Academic Self-Efficacy	.18	.09	.30	.81	1.00	
6. Chemistry Academic Self-Efficacy	.22	.11	.37	.61	.73	1.00

Note. Correlation coefficients greater than .10 are significant at $p < .05$.

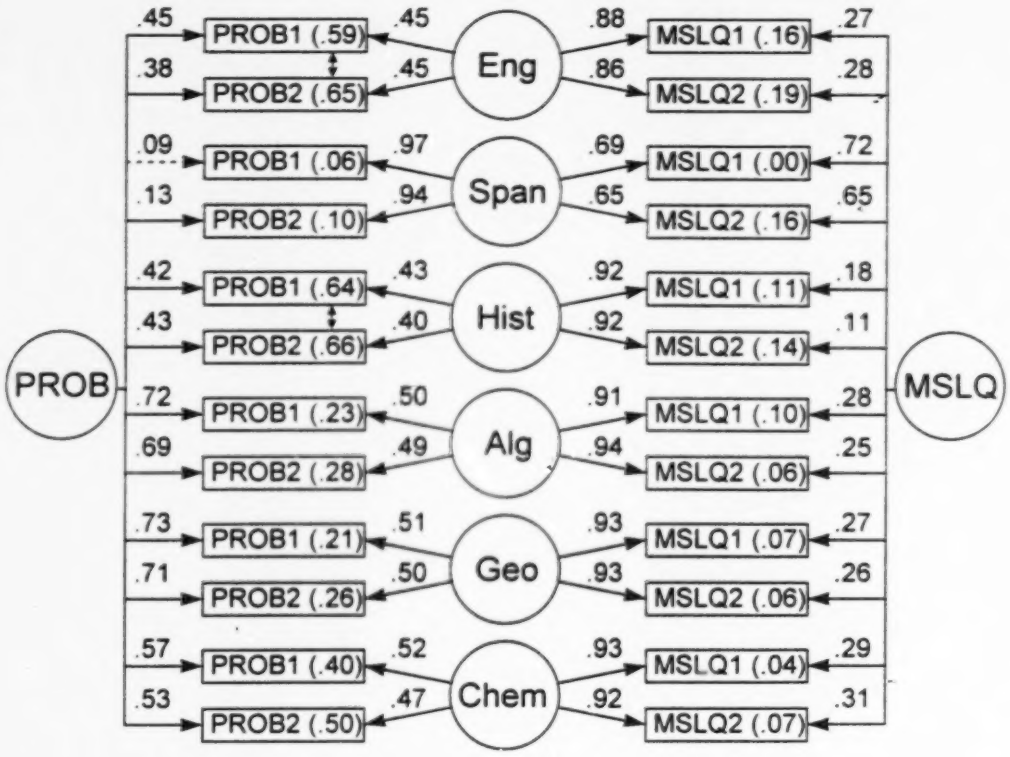

Figure 1. Multi-trait multi-method model with six correlated traits and two correlated methods. Dotted lines denote nonsignificant paths ($p > .05$). Eng = English; Span = Spanish; Hist = American history; Alg = algebra; Geo = geometry; Chem = chemistry; Prob = problem-referenced; MSLQ = Motivated Strategies for Learning Questionnaire.

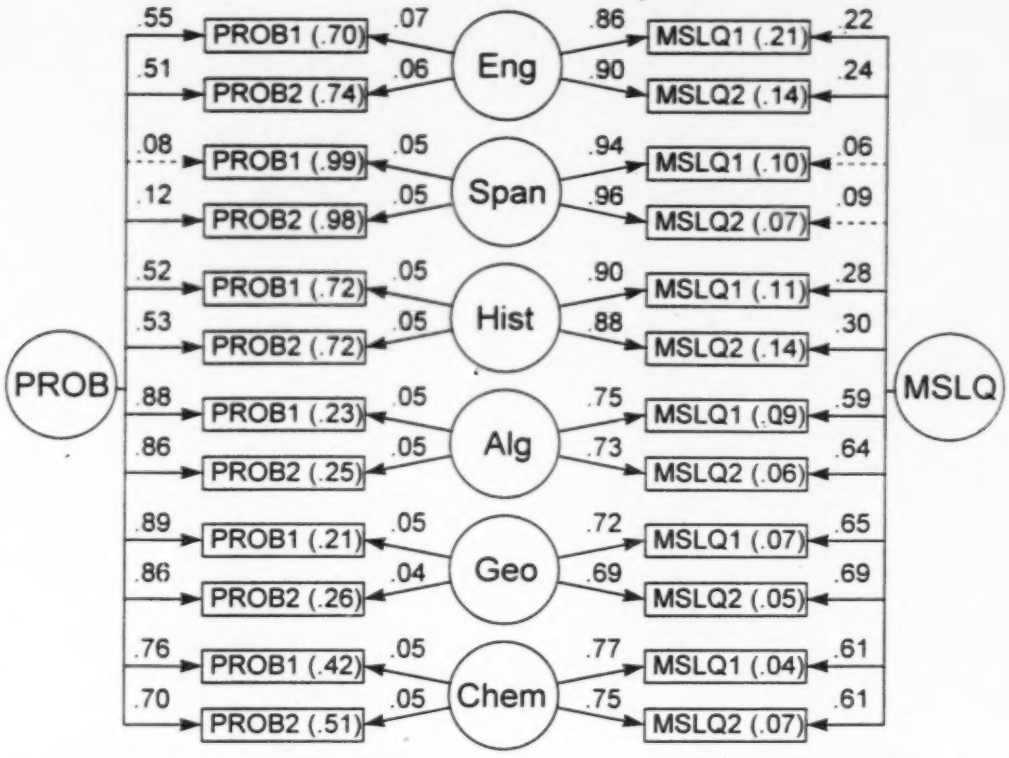

Figure 2. Multi-trait multi-method model with equality constraints imposed on trait effects. Dotted lines denote nonsignificant paths ($p > .05$).

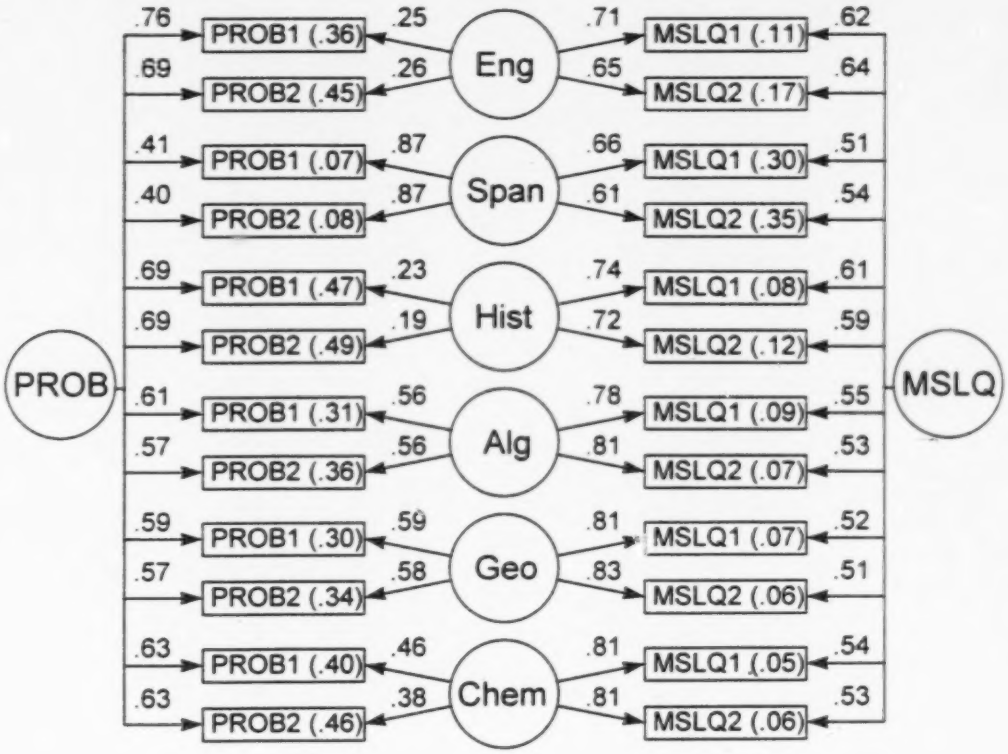

Figure 3. Multi-trait multi-method model with equality constraints imposed on method effects.